

REMARKS

By the present Amendment, claim 1 has been amended. Claims 19-24 have been cancelled. Claim 25 is newly presented for consideration. Accordingly, claims 1, 2, 6, 8, 12, 16-18, and 25 are now pending in the application. Claim 1 is independent.

In the Office Action of January 4, 2011, claims 1, 2, 8, and 12 were rejected under 35 USC §103(a) as being unpatentable over JP 02-154745 to Kazuteru in view of JP 05-000138 to Yoichi. Claims 16-18 are rejected under 35 USC §103(a) as being unpatentable over Kazuteru in view of Yoichi, and further in view of U.S. Patent No. 5,517,994 to Burke et al. ("Burke"). Claims 19-24 were rejected under 35 USC §103(a) as being unpatentable over Kazuteru in view of Yoichi in view of JP 05-253335 to Aloka. These rejections are respectfully traversed.

Applicants would like to thank Examiners Gupta and Chen for the courtesy and cooperation extended during the interview conducted on March 29, 2011. During the interview, Applicants discussed the features of independent claim 1 and provided a proposed amendment to try and clarify the subject matter recited therein. Specifically, Applicants indicated that the frame rate selected by the control section when the probe has been left in the air is such that moving image reproduction is still possible. In contrast, the cited reference reduced the ultrasound pulse transmission rate to 1/100 times the normal transmission rate, which would not provide meaningful diagnostic information if images were obtained. The Examiner indicated that it was unclear how the normal frame rate was determined or what frame rate would be considered sufficient for moving image reproduction. Applicants agreed to amend the claims to better clarify these features or identify where such features are described in the Specification.

Claims 1, 2, 8, and 12 were rejected under 35 USC §103(a) as being unpatentable over Kazuteru in view of Yoichi. Regarding this rejection, the Office Action indicates that Kazuteru discloses an ultrasonic diagnostic apparatus that includes a probe that transmits/receives ultrasonic waves, a transmitting section that supplies a drive signal to the probe, a receiving section that receives a reflection echo signal, and an image constructing section that reconstructs a diagnostic image. The Office Action further indicates that Kazuteru discloses a display section that displays the diagnostic image, and a control section that controls the different sections. The ultrasonic diagnostic apparatus is further indicated as including a judging section configured to judge, on the basis of the diagnostic image information, which is reconstructed from the image constructing section when the probe transmits/receives ultrasonic waves that the probe is left in the air. The Office Action admits that Kazuteru fails to disclose that when the judging unit judges that the probe is left in the air, the control section controls the drive signals supplied to the probe so as to reduce the frame rate to a value that is lower than the present frame rate, but in a range sufficient for moving image reproduction of the diagnostic image. Yoichi is relied upon for disclosing that when a probe is determined to be neglected in the air, it is more appropriate to control wave transmission or slow or reduce the frame to one time per 100 frames. The Office Action concludes that it would have been obvious to modify the ultrasonic diagnostic imaging system of Kazuteru with the frame reduction feature of Yoichi in order to control the generation of heat of the ultrasonic probe. Applicants respectfully disagree.

By the present Amendment, Applicants have amended the claims in an attempt to better clarify the features of the invention that are not believed to be

shown or suggested by the art of record. As amended, independent claim 1 defines an ultrasonic diagnostic apparatus that comprises:

- a probe that transmits/receives ultrasonic waves to/from a test subject;
 - a transmitting section that supplies a drive signal to the probe;
 - a receiving section that receives a reflection echo signal outputted from the probe;
 - an image constructing section that reconstructs a diagnostic image on the basis of the received reflection echo signal;
 - a display section that displays the diagnostic image constructed by the image constructing section; and
 - a control section that controls these sections,
- wherein the ultrasonic diagnostic apparatus includes a judging section configured to judge whether the probe has been left in the air based on comparison of a predetermined image obtained with the probe being left in the air to the diagnostic image information which is reconstructed from the image constructing section when the probe transmits/receives ultrasonic waves, and when the judging unit judges that the probe is left in the air, the control section controls the drive signals supplied to the probe from the transmitting section so as to reduce the frame rate to a value that is lower than an ordinary frame rate but in a range sufficient for moving image reproduction of the diagnostic image.

The ultrasonic diagnostic apparatus of independent claim 1 includes a probe which transmits/receives ultrasonic waves to/from a test subject, a transmitting section that supplies a drive signal to the probe, a receiving section that receives a reflection echo signal output from the probe, an image reconstruction section that reconstructs a diagnostic image based on the received echo signal, and a display section that displays the diagnostic image constructed by the image construction section. A control section is provided for controlling the probe, transmitting section, receiving section, image reconstructing section, and display section. A judging section is further provided to determine whether the probe has been left in the air by

comparing diagnostic image information that is reconstructed from the image constructing section when the probe transmits/receives ultrasonic waves to a predetermined image obtained when the probe has actually been left in the air. If the judging section determines that the probe has been left in the air, then the control section controls the drive signals supplied to the probe from the transmitting section to reduce the frame rate to a value that is lower than an ordinary frame rate but in a range that is sufficient for moving image reproduction of the diagnostic image.

As discussed in the specification, the judging section (70) can be configured to include an image memory (72), a comparison reference data memory (74), and a judging circuit (76). The image memory is used to store the B image read from the frame memory as comparison data. The comparison reference data memory is used to store the B image imaged when the probe is left in the air as comparison reference data. See paragraph [0070] of the published application. The comparison reference data is collected beforehand in order to define a state where the probe is actually left in the air, for example, by executing the ultrasound imaging process and a frame image (F0) is acquired. The acquired frame image (F0) is then stored in the comparison reference data memory as comparison reference data. See paragraphs [0071] - [0073]. During operation of the ultrasonic diagnostic apparatus, ultrasound imaging is executed and a frame image (F1) is acquired and stored in the image memory. The frame image (F0) is read from the comparison reference data memory and compared to frame image (F1) and a difference value is computed. When the difference corresponds to a set range, the frame image (F0) and the frame image (F1) are judged to be substantially identical, and the frame rate is reduced.

As further discussed in the Specification, the ordinary frame rate of the B image is 30 Fps. When the probe is determined to have been left in the air, the

frame rate is reduced a value that is lower than the ordinary frame rate. This value can be set, for example, to 10 Fps, so as to fall within the range of 1/2 (15 Fps) to 1/6 (5 Fps) of 30 Fps, which is a frame rate sufficient for moving image reproduction. See paragraph [0074].

Contrary to the assertions made in the Office Action, Yoichi only determines whether the probe has been left in the air. There is no disclosure or suggestion for reducing the frame rate to a point where it remains possible to have moving image reproduction of the diagnostic image. Rather, Yoichi indicates that wave transmission from the ultrasonic probe is interrupted or controlled by a wave transmission control means. See paragraph [0007]. The transmitting beamformer then controls transmission of ultrasonic waves such that only one ultrasonic wave is transmitted from the ultrasonic probe every 100 times a system trigger occurs in order to detect whether the ultrasonic probe has been placed in contact with the body. If it is determined that the ultrasonic probe has been placed in contact with the body, then the wave transmission control signal is terminated and the normal operational state is reinstated. See paragraph [0016]. As can be appreciated, this results in a single trigger for transmitting the ultrasonic wave, which is, too low for relevant moving image reproduction of the diagnostic image. Thus, Yoichi never performs moving image reproduction when the probe is left in the air.

In contrast, independent claim 1 provides an arrangement wherein the frame rate is only reduced to a level which continues to allow acquisition of the diagnostic image. This is clearly not disclosed or even suggested by Yoichi. Accordingly, the combination of Kazuteru and Yoichi still fails to provide any disclosure or suggestion for features recited in independent claim 1, such as:

wherein the ultrasonic diagnostic apparatus includes a judging section configured to judge whether the probe has been left in the air based on comparison of a predetermined image obtained with the probe being left in the air to the diagnostic image information which is reconstructed from the image constructing section when the probe transmits/receives ultrasonic waves, and when the judging unit judges that the probe is left in the air, the control section controls the drive signals supplied to the probe from the transmitting section so as to reduce the frame rate to a value that is lower than an ordinary frame rate but in a range sufficient for moving image reproduction of the diagnostic image.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 2, 6, 8, 12, 16-18, and 25 depend from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record. For example, newly presented claim 25 provides a specific range for reducing the frame rate in order to maintain moving image reproduction. Again, the cited references provide no disclosure or suggestion for such features.


For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 520.45475X00).

Respectfully submitted,
ANTONELLI, TERRY, STOUT & KRAUS, LLP.

/Leonid D. Thenor/ 
Leonid D. Thenor
Registration No. 39,397

LDT/vvr
1300 N. Seventeenth Street
Suite 1800
Arlington, Virginia 22209
Tel: 703-312-6600
Fax: 703-312-6666

Dated: April 4, 2011